George C. Marshall Space Flight Center
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Revision C
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ORGANIZATIONAL INSTRUCTION

RADIOGRAPHIC FILM INTERPRETATION

OPR(s)	OPR DESIGNEE
QD10, QD20, QD30, and QD40	Bobby Rains

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Revision	New Baseline	9/09/02	This OI replaces QS10-QA-011 Rev. D. When changing to the new numbering scheme outlined in QS-A-001 rev. F, there was a duplication of numbers; therefore this OI was changed to the next sequential number of QS-QA-029. Format and numbering change to implement requirements of QS-A-001 rev F.
Revision	A	05/07/03 1	Changes made to reflect new organization and electronic forms. Revised document reference in Applicable Documents. Deleted verbally reference in section 4.6.1. Added to section 4.6.2.e to include the distance from film to the source side of the inspected component for unusual configuration s. Revised wording to document anomaly in section 4.6.3.
Revision	B	10/1/04	Revised to bring document in compliance with the HQ Rules Review Action (CAITS: 04-DA01-0387). Changes were also made to reflect S&MA organizational name changes (i.e., QS to QD).
Revision	C	11/22/05	Administrative Revision changed OPR

RADIOGRAPHIC FILM INTERPRETATION

1. PURPOSE, SCOPE, APPLICABILITY

1.1. Purpose – This instruction complies with MPG 8730.1.

1.2. Scope – This instruction provides the general requirements for radiographic film evaluation and interpretation. Activities associated with operating x-ray equipment shall be covered under Materials, Processes, and Manufacturing (MP&M) Department or MSFC Contractor procedures.

1.3. Applicability – This instruction is applicable to all MSFC Safety and Mission Assurance Office (S&MA), NDE Team and contractor personnel who interpret radiographic film.

2. DOCUMENTS

2.1. Applicable Documents

MPR 8730.1 Inspection and Testing

MWI 3410.1 Personnel Certification Program

2.2. Reference Documents – The following reference documents provide additional information concerning the subject of Radiographic Film Interpretation:

ANSI/AWS D1.1	*Structural Welding Code*
ASME Section V	*Nondestructive Evaluation*
ASTM E 1742	*Standard Practice for Radiographic* Examination
MSFC-STD-1249	*Standard NDE Guidelines and Requirements for Fracture Critical Programs*
MSFC-STD-481	*Acceptance Standard for Fusion Welded* Joints

3. DEFINITIONS

NONE

4. INSTRUCTIONS

4.1. Film Viewers

4.1.1 The viewer shall contain a variable control to allow selection of optimum intensities for film with varying densities.

4.1.2 The light source shall have sufficient intensity to enable viewing of film densities in the area of interest. The light enclosure shall be such as to permit a uniform brightness level over the entire viewing screen.

4.1.3 A set of opaque masks, an iris type aperture, or other method to reduce the viewing area to suit the size of the area of interest shall be provided.

4.1.4 The film viewing area shall be an area with subdued lighting to preclude objectionable reflective glare from the surface of the film under examination.

4.2 Densitometers.

4.2.1 The densitometer shall be capable of measuring light transmitted through a radiograph with a film density up to 4.0 with a density resolution of 0.02.

4.3 Surface Preparation.

4.3.1 Components may be examined without surface preparation or conditioning except as required for removing surface irregularities that may interfere with proper interpretation of radiographs.

4.4 Radiographic Identification.

4.4.1 Each radiograph shall carry the identification or serial number of the component and view number, when multiple views are taken. Radiographs of a repair area shall be identified with R1, R2, and so forth, indicating number of times repairs were attempted. For explosives and propellants, the conditioning temperature shall be identified on each X-ray film if the ordnance has been conditioned to a temperature other than facility ambient for purposes of examination.

4.4.1.1 All portions of welds that have been repaired shall be re-radiographed by using the appropriate techniques with a minimum amount of film overlap of two inches beyond the repair edges.

4.5 Radiographic Interpretation.

4.5.1 Level II or III personnel shall evaluate all radiographs.

4.5.2 The interpreter should wait sufficient time, after entering the viewing area, before interpreting radiographs. If the eyes are subjected to the full brightness of the illuminator, at

least a 30-second readaptation shall be allowed.

4.5.3 Step-wedge calibration films traceable to the National Institute for Standards and Technology (NIST) shall be used for checking densitometer calibration.

4.5.4 Radiography shall be performed with a technique of sufficient sensitivity to satisfactorily display an acceptable image of the required penetrameter and the specified essential hole. Photoelectric densitometers shall be used for assuring compliance with density requirements.

4.5.5 Film density tolerances through the area of interest shall be within minus 15% and plus 30% of the density through the appropriate penetrameter.

4.5.6 All radiographs shall be free from artifacts in the area of interest to the extent that they cannot mask or be confused with the image of any discontinuity in the material being radiographed.

4.6 Accept/Reject Criteria

4.6.1 The accept/reject criteria shall be noted on the engineering drawings or other design documentation prior to the evaluation.

4.6.2 All radiographs shall be accompanied with a review form and data listing the actual radiographic testing (RT) technique parameters (technique sheet). The technique sheet shall include, but is not limited to:

a. Type and identification of weld.

b. Weld and parent metal thickness and type of material.

c. Type of radiation source, focal spot or source size, x-ray equipment voltage rating and manufacturer.

d. Film brand and type.

e. Exact source-to-film distance. Also, the distance from the source side of the inspected component to the film should be noted for any unusual configurations so that geometric unsharpness can be calculated.

f. Exposure conditions: KV-MA or Curies and time.

g. Thickness of lead screens

h. Description of blocking or masking techniques.

i. Work order number, test preparation sheet number, contract number as applicable.

j. Notation of all apparent weld imperfections and recommended disposition of the radiographs as acceptable or rejectable to the governing code or specification.

k. Interpreter's identification and certification level.

l. Shooting sketch.

4.6.3 MSFC QA personnel shall stamp and date the applicable test preparation sheet, work order, or other applicable work authorizing document if the film is found to be acceptable, (if electronic, affix password protected initials/signature). If the film is rejected, contact the appropriate NASA engineer and contractor for resolution and disposition, then document the anomaly on the appropriate nonconformance form.

4.6.4 When the radiography is performed by an in-house MSFC organization the review form shown in Appendix B may be used to accompany the radiograph.

5. NOTES

5.1 Directive Replacement – This issuance replaces QS10-QA-011 Revision D, "Radiographic Film Interpretation", dated 3/6/00.

5.2 Records are maintained in the Quality Assurance Records Center for flight hardware and are maintained by the using organization for test stand and facility hardware.

6. SAFETY PRECAUTIONS AND WARNING NOTES

This procedure applies only to film interpretation. No special safety precautions are required for this activity. In the event that, MSFC QA personnel are required to evaluate actual performance of radiographic inspection, the safety precautions and procedures of the performing organization/contractor apply.

7. APPENDICES, DATA, REPORTS, AND FORMS

Appendix A Record of Radiographic Inspection

8. RECORDS

None.

9. TOOLS, EQUIPMENT, AND MATERIALS

9.1 Viewing facilities shall provide subdued background lighting of an intensity that will not

cause troublesome reflections, shadows, or glare on the radiograph. Equipment used to view radiographs for interpretation shall provide a light source sufficient for the essential penetrameter hole to be visible for specified density range. The viewing conditions shall be such that light from around the outer edge of the radiograph or coming through low-density portions of the radiograph does not interfere with interpretation.

10. PERSONNEL TRAINING AND CERTIFICATION

All MSFC QA personnel that interpret radiographs for acceptance of hardware will be certified in accordance with MWI 3410.1.

11. FLOW DIAGRAM

None

Appendix A

RECORD OF RADIOGRAPHIC INSPECTION

TPS/WORK AUTH.#_____ PROG./PROJ. _____ INSP. DATE _____ CLASS_____

INSP. PROC. # _____ ACCP. SPEC. # _____

PART # _____ SERIAL # _____

DWG. # _____ PART NAME/DESCRIPTION _____

_____

MATERIAL TYPE_____ MATERIAL THICKNESS_____

WELD THICKNESS_____ PENETRAMETER SIZE_____

PENE. SENSITIVITY_____ RADIATION SOURCE_____

METHOD (CIRCLE ONE) DOUBLE SINGLE WALL

KV/CI_____ MA_____ FFD_____ FILM TYPE_____

SCREENS: FRONT_____ BACK _____

EXPOSURE TIME_____ WELD BEAM ANGLE _____

DEFECT CODES:
1. SLAG INCLUSION (SI)
2. POROSITY (P)
3. TUNGSTEN INCLUSION (TI)
4. LACK OF FUSION
5. CRACK LIKE INDICATION
6. INCOMPLETE PENETRATION
7. UNDERCUT
8. ARTIFACTS

REMARKS (USE PAGE 2 IF NECESSARY) _____

_____

_____

INSPECTOR _____ LEVEL_____

EMPLOYER_____

INSPECTOR_____ LEVEL_____

EMPLOYER_____

Appendix B

RECORD OF RADIOGRAPHIC INSPECTION

LOCATION VIEW	1^{ST} A/R	DEF	2^{ND} A/R	DEF	DEFECT CODE: